FIG. 1a

FIG. 1b

O ●————————● F    FIG. 1c

FIG. 1d

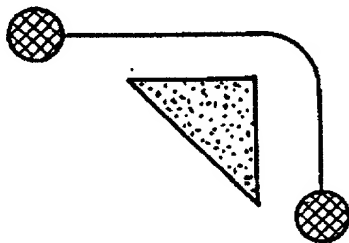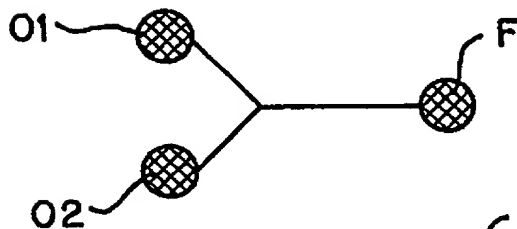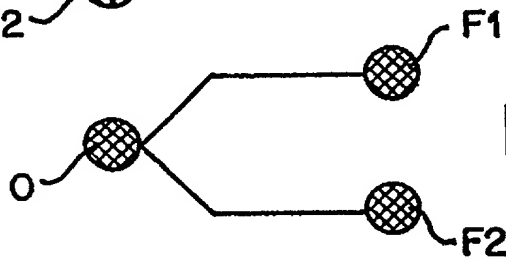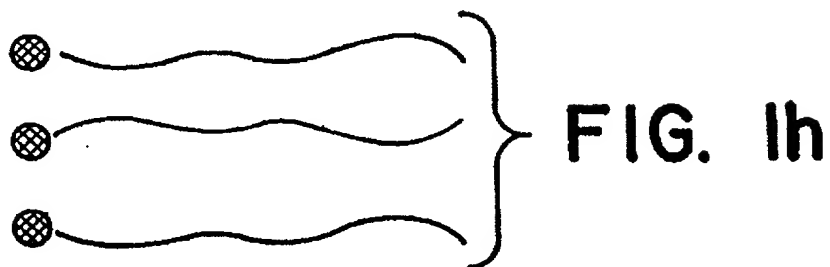FIG. 1e

O1 ●
O2 ●    F    FIG. 1f

F1
O ●    F2    FIG. 1g

FIG. 1h

FIG. 2A



FIG. 2B



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## FIG. 2C
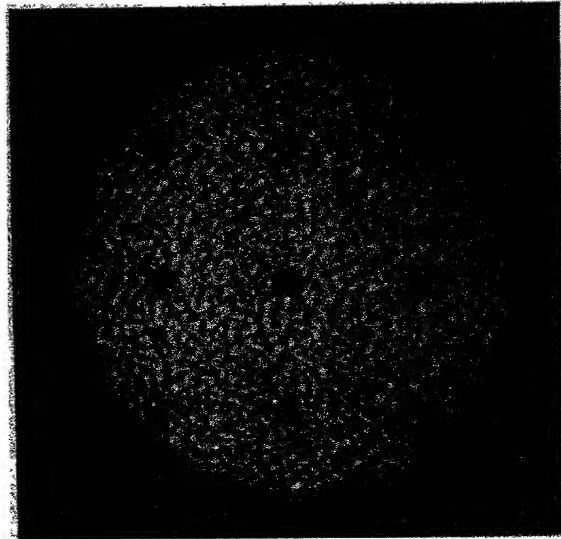


## FIG. 2D

# FIG. 3a



# FIG. 3b

## FIG. 3C



34

32
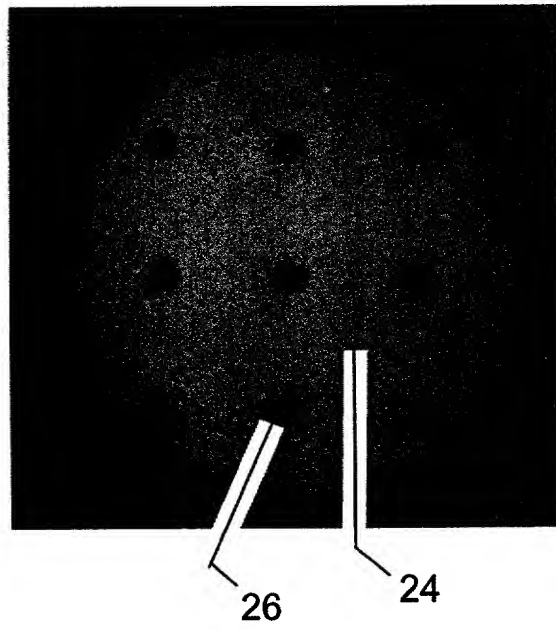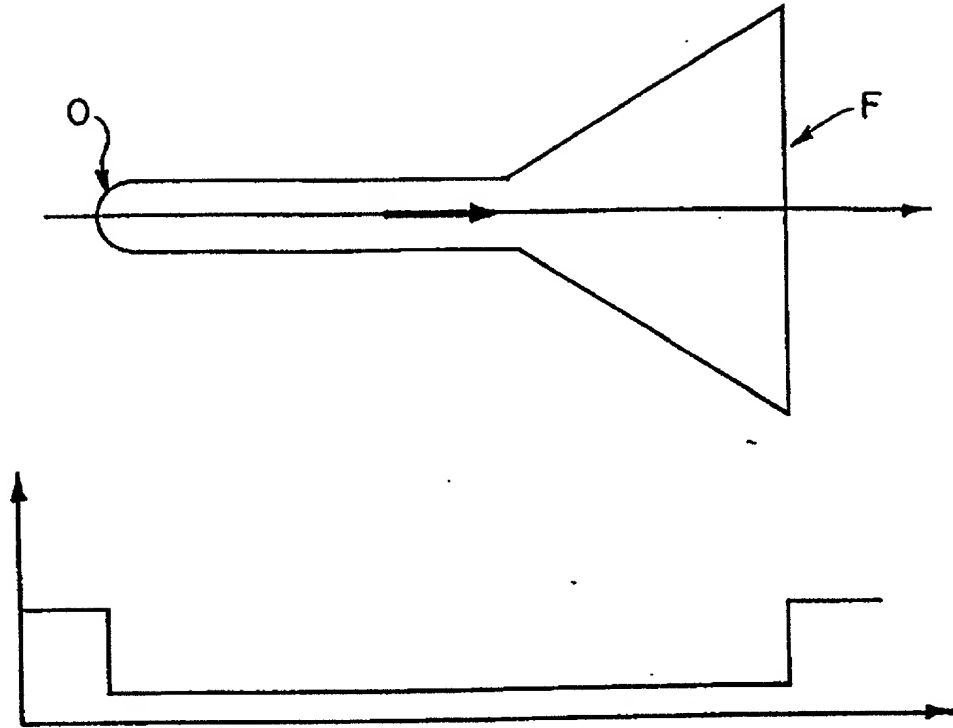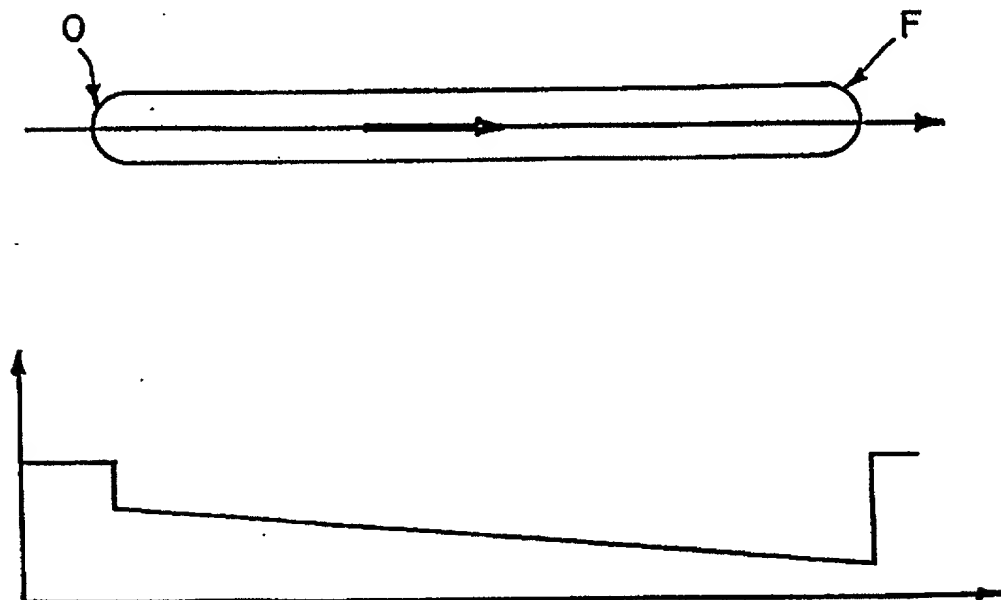
## FIG. 3D

# FIG. 4A
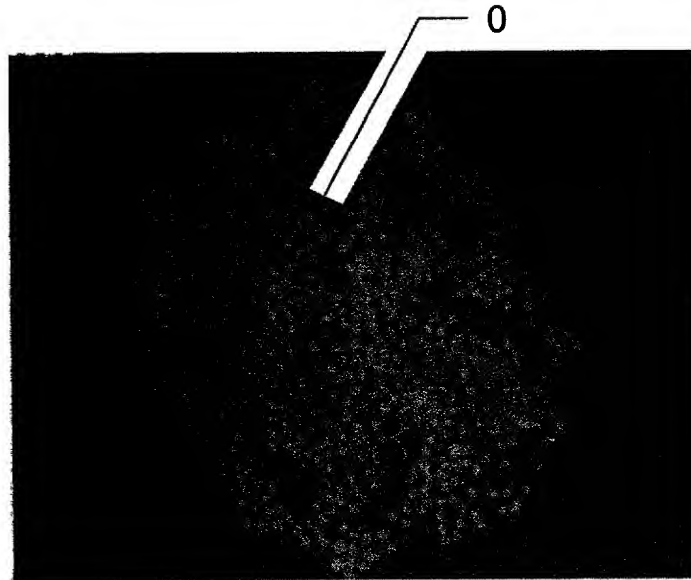


# FIG. 4B
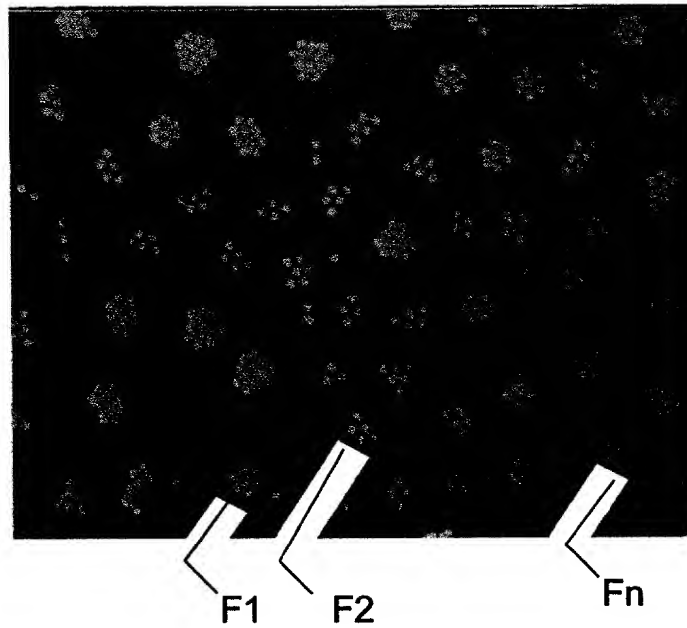
# FIG. 5
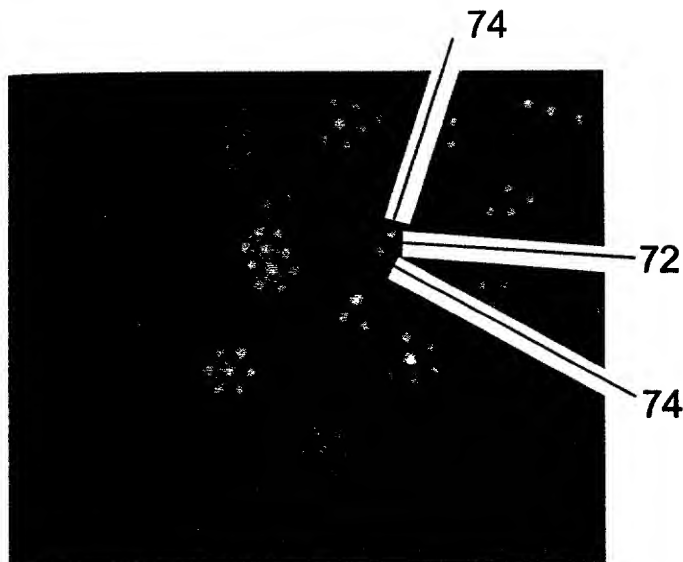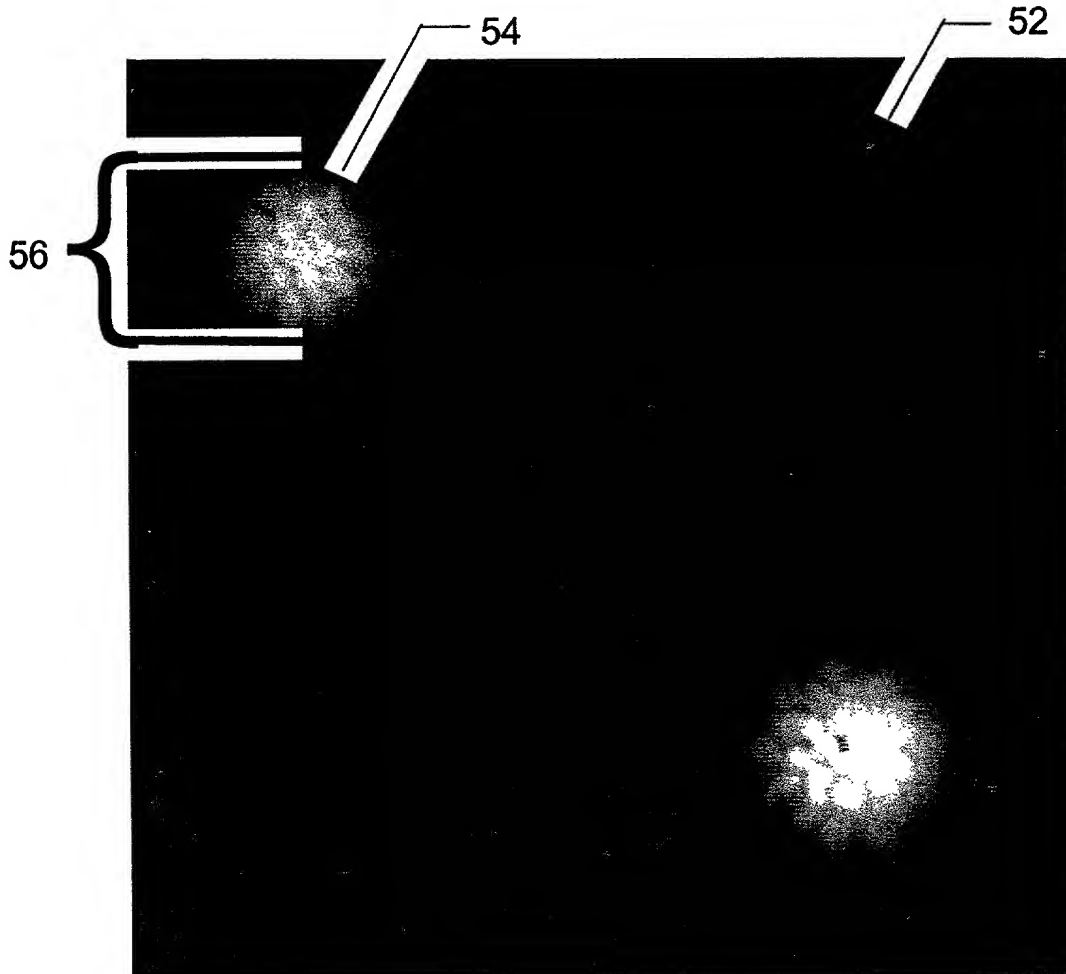


# FIG. 7

# FIG. 6a



# FIG. 6b



# FIG. 6c

# FIG. 8



Mixed Phase

Form Complex
on Bead

Post form
Array

Form Complex
on Planar Surface

Capture Complex

Form Complex
in Solution

Liquid Phase

Solid Phase
(Pre-form Array)

LEGEND

P— PROBE
T— TARGET
PT—P-T COMPLEX

# FIG. 9a

Flow along Conduit

Transverse Flow

92

# FIG. 9b

Illuminated  Zone



# FIG. 9c

FIG. 10

# FIG. IIa

Local fluid velocity

# FIG. IIb

# FIG. IIc

Light

Light induced flow field

# FIG. IId
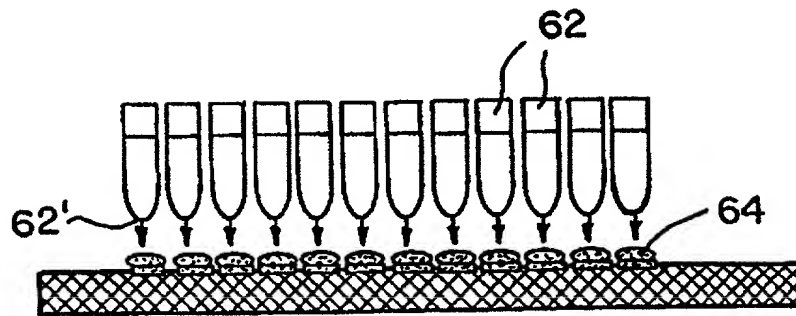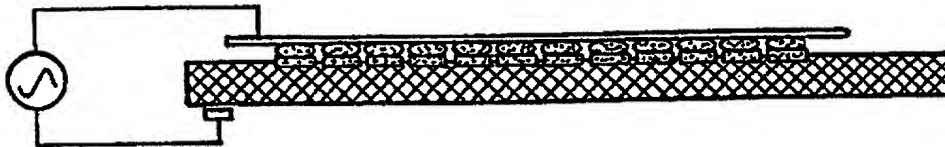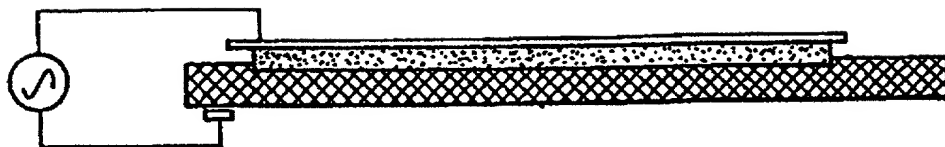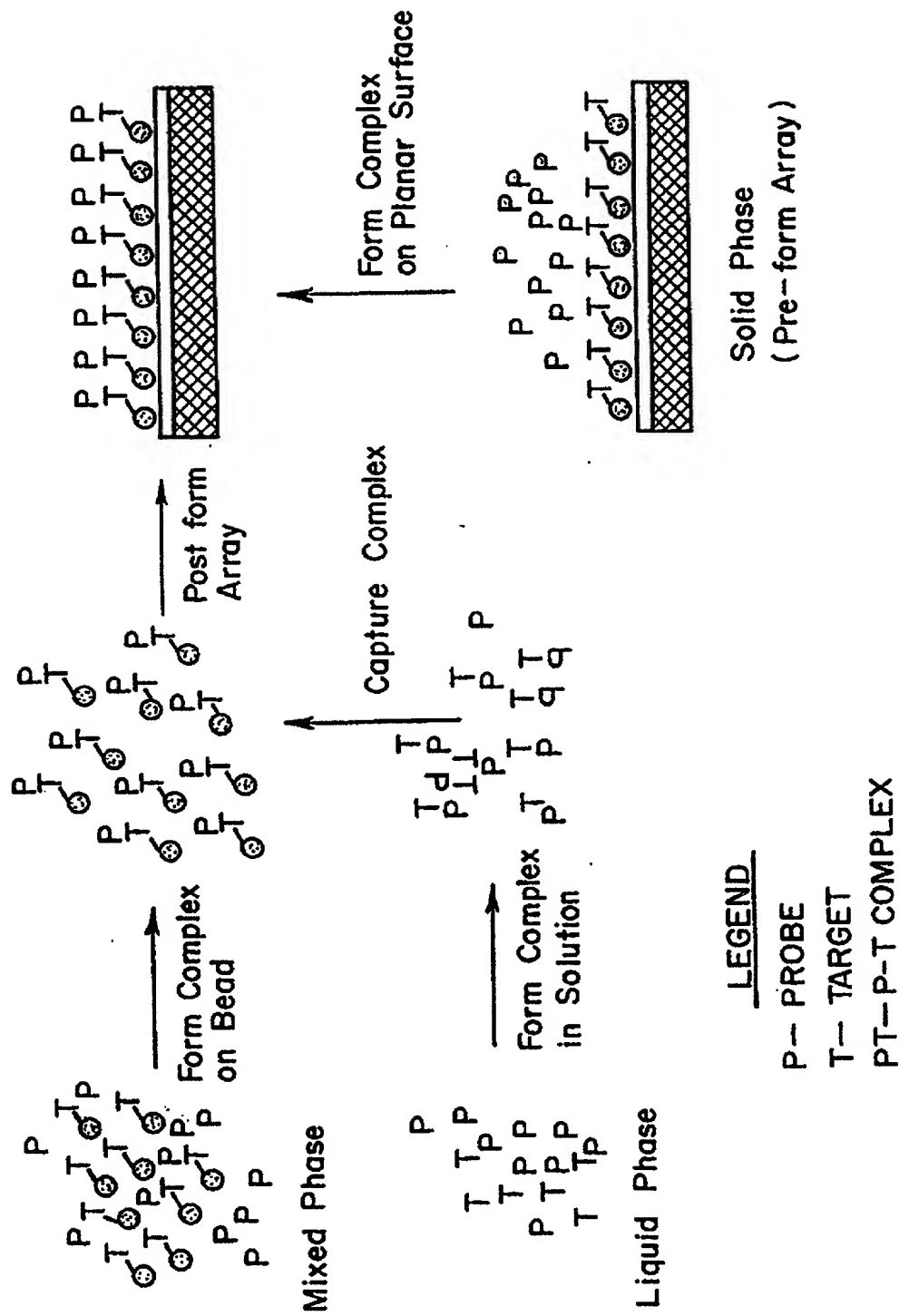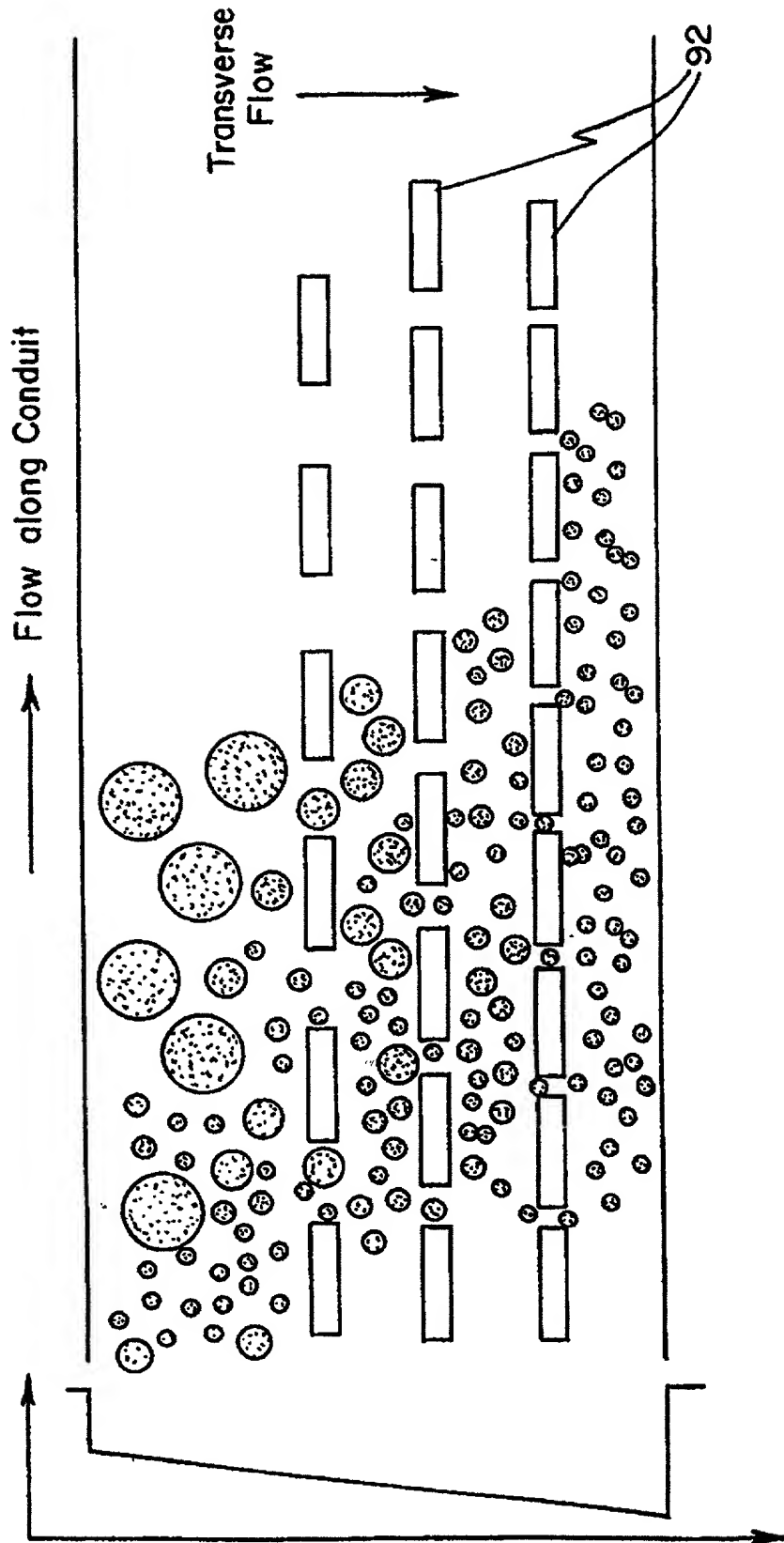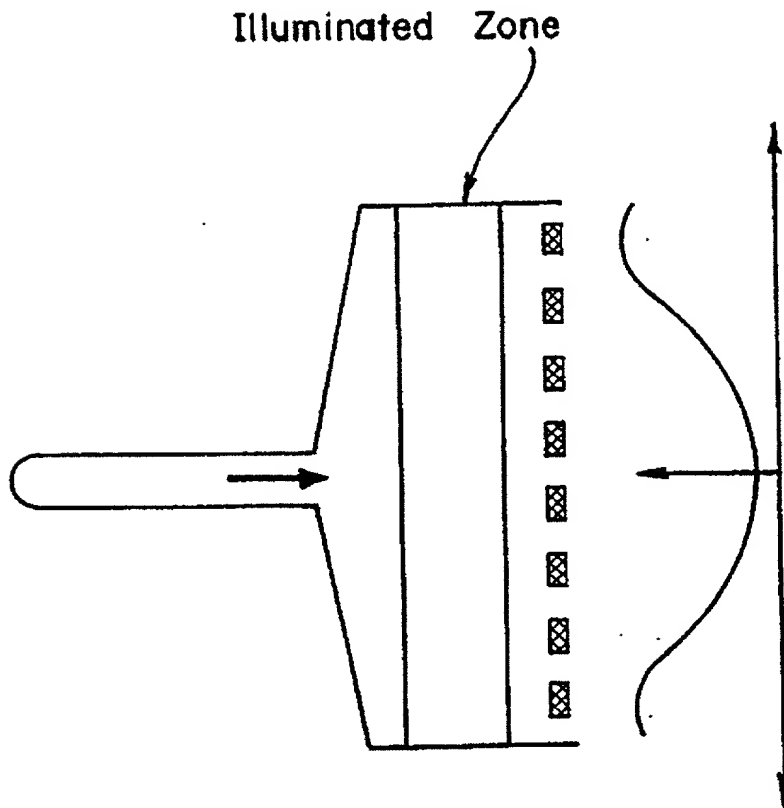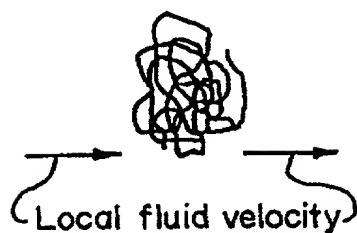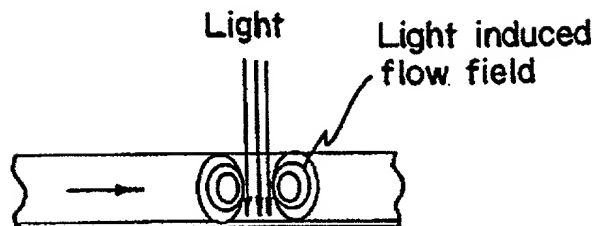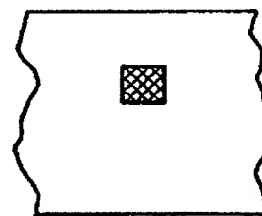
# FIG. IIe
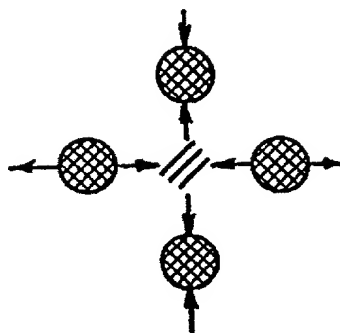
# ILLUMINATION PATTERN GENERATOR



Fig 12
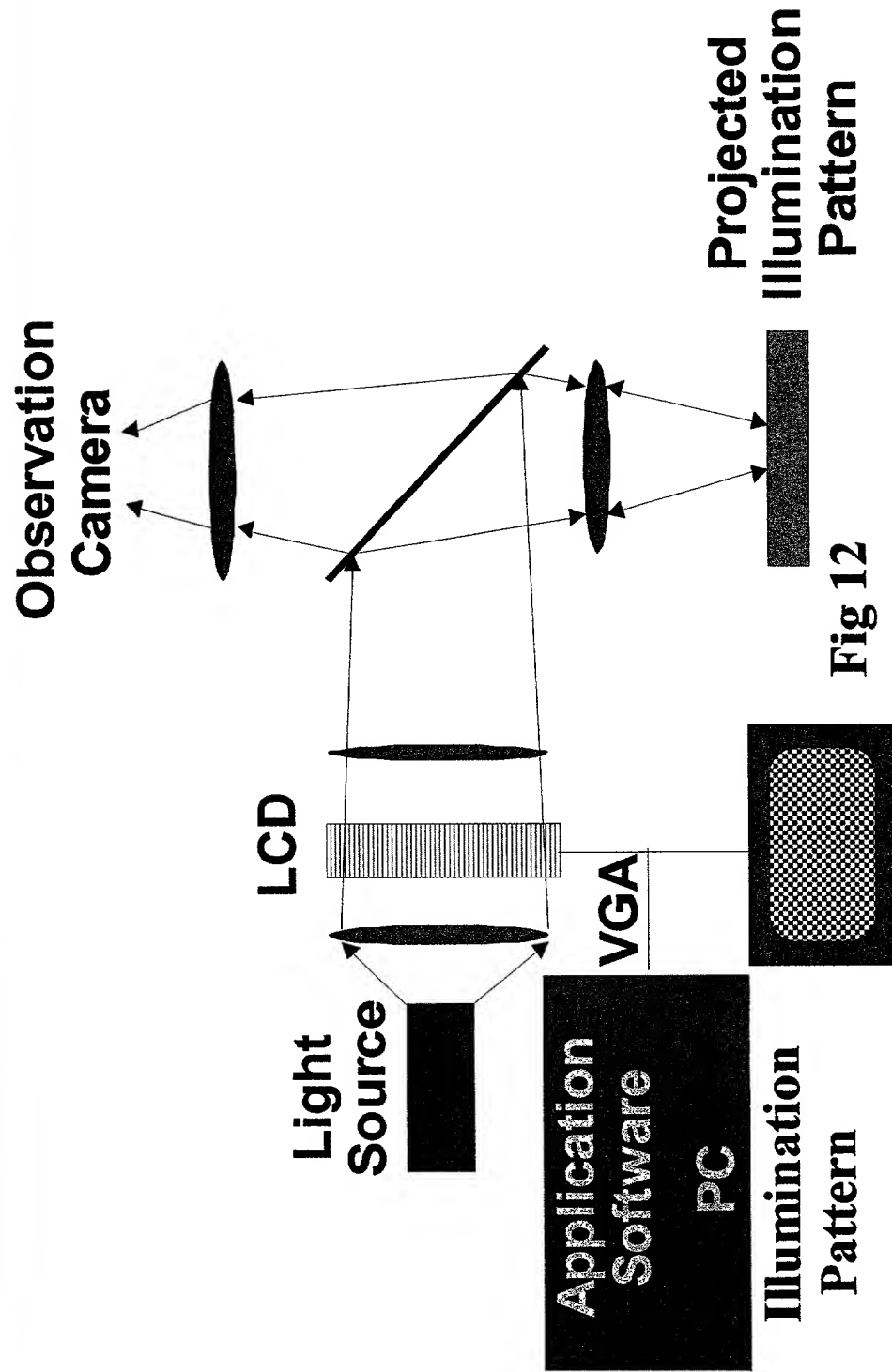
# LCD-PARSE OPTICAL DESIGN

ON-LINE
INSPECTION

CCD

LC

OBJECTIVE
LENS

SAMPLE

ILLUMINATION SYSTEM

LIGHT SOURCE

LCD

LC

$L_I$
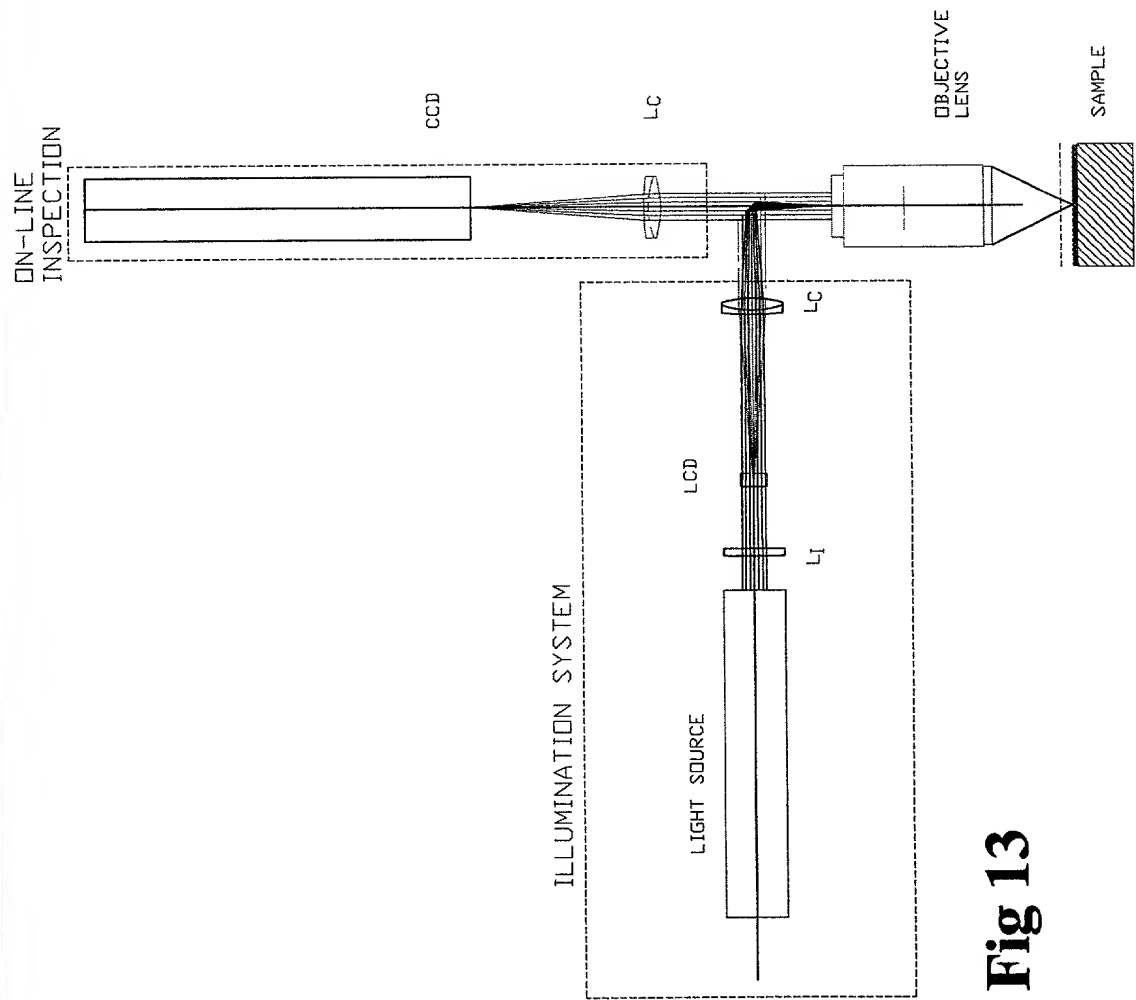
**Fig 13**

# ARRAY SHAPE ADJUSTMENTS

CIRCLE

HORIZONTAL LINE
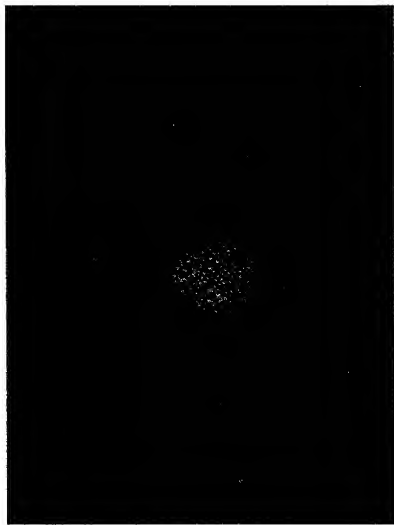
**Figure 14c**
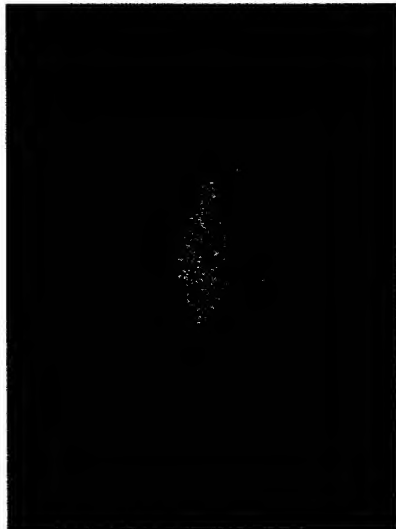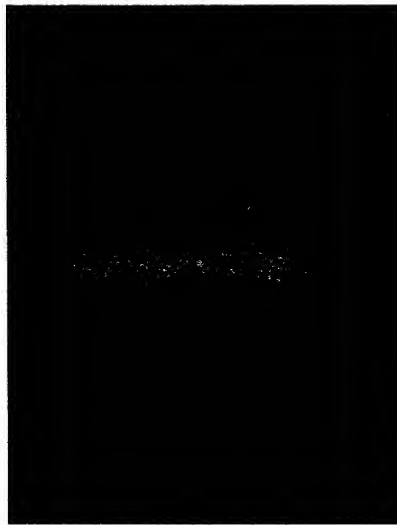
VERTICAL LINE

SQUARE

**Figure 14d**

**Figure 14a**

**Figure 14b**

# COLLECTION AND ARRAY ASSEMBLY



14_05_99 16-53-13.bmp2.2um bead attract to lighted area at 10KhZ, 10VP-P, 1V off,0.2A Laser
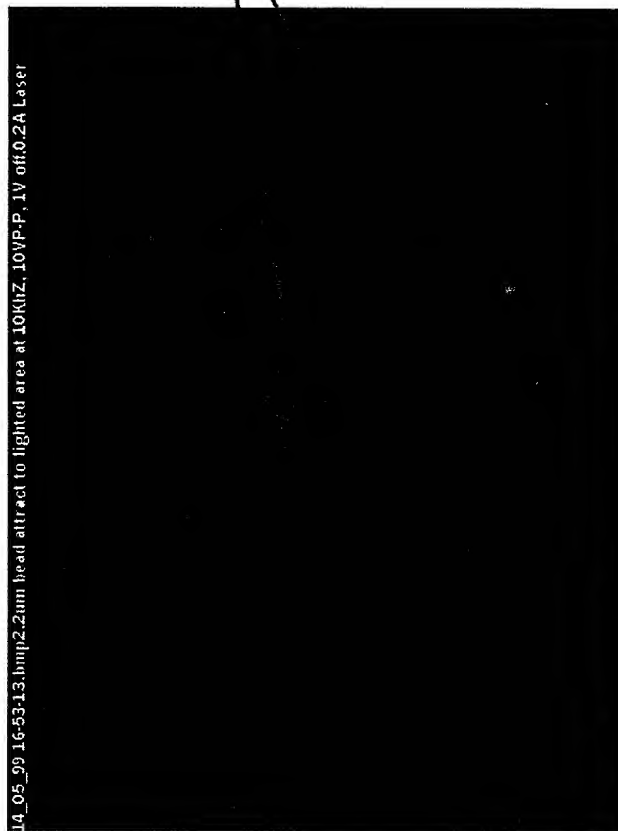
CollectedParticles

## Figure 15a

# EXPULSION AND CONFINEMENT



**Confined Particles**

**Illuminated Regions**

**"Ghost" Image**

14_05_99 16-54-05.bmp;2.2um bead Rejected from lighted area at 10KhZ, 10VP-P, 1V off,0.25 A Laser

## Figure 15b

# DRAG AND DROP
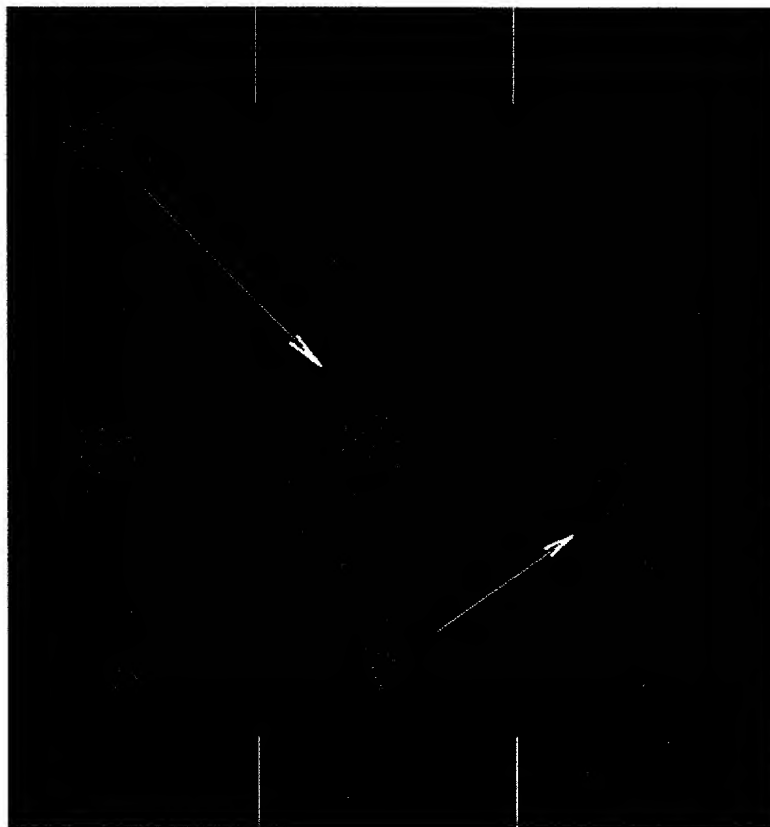


Figure 16

# Porgrammable Array Reconfiguration and Segmentation



**Dynamic Bead Array with Labeled Subarray**

**Illumination of Subarray Boundary**

**Array Segmentation**

Illumination Profile

## Figure 17

# LCD PARSE



Figure 18a

Figure 18b

LCD PARSE



Figure 19

# FRACTIONATION

**Differential Frequency Dependence of Particle Expulsion**
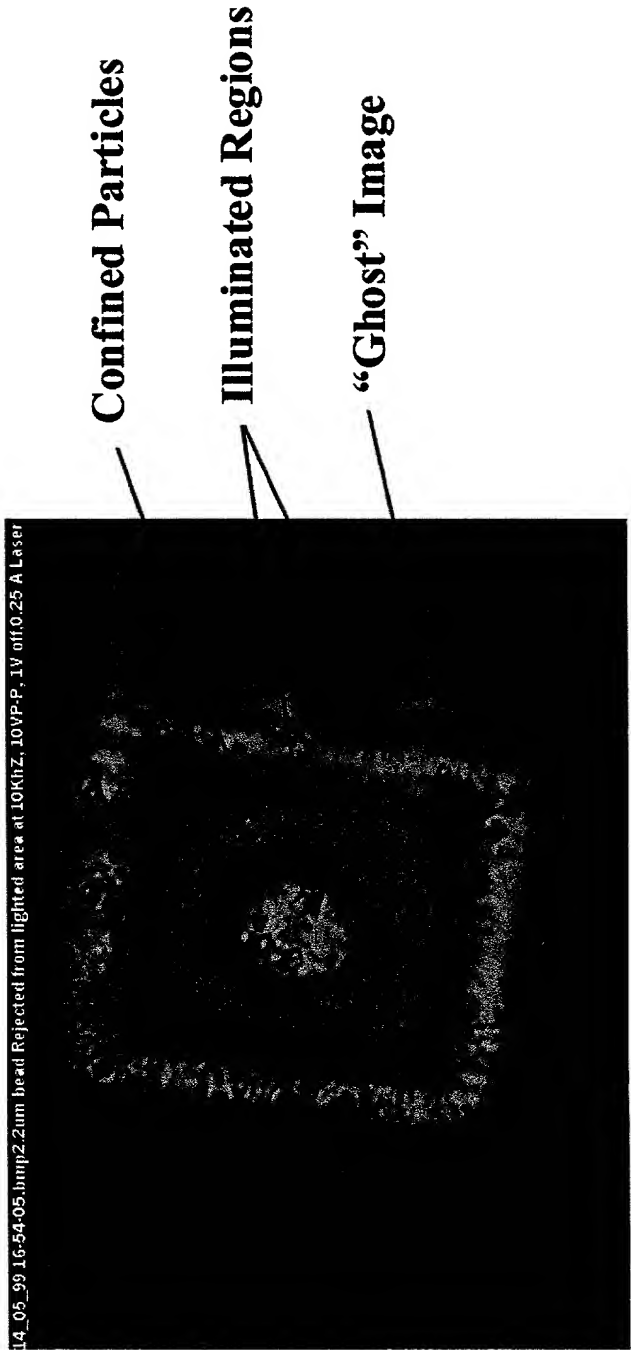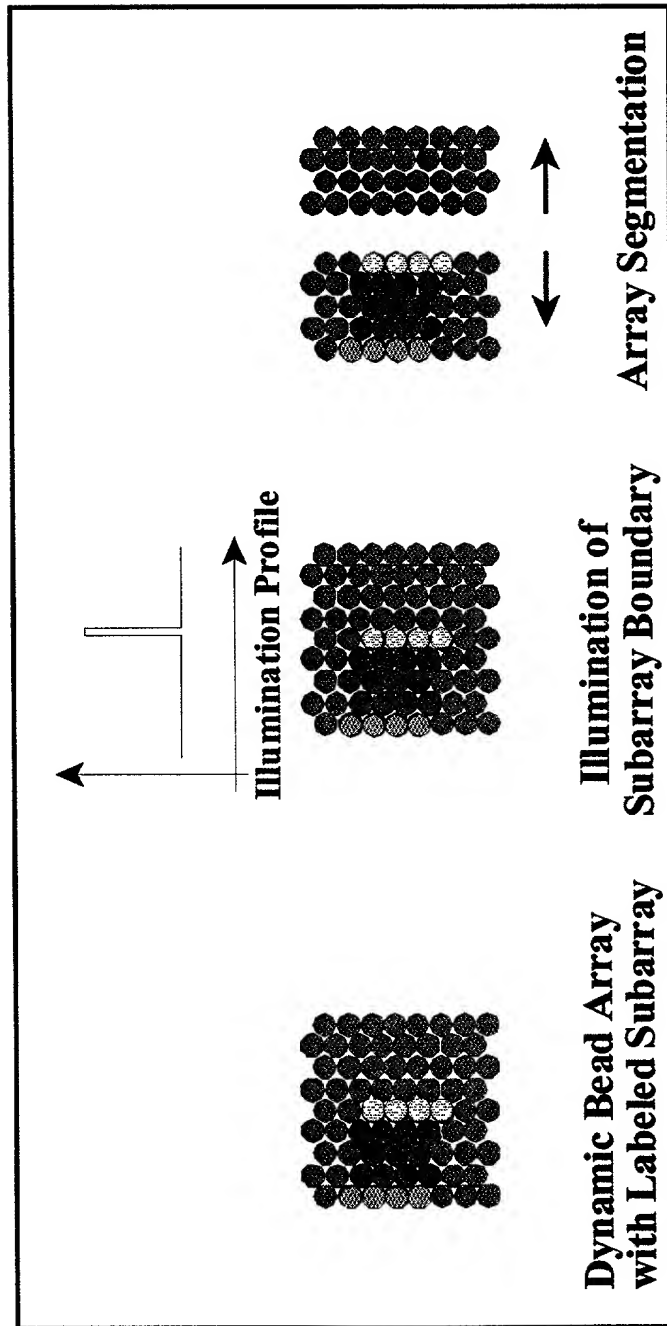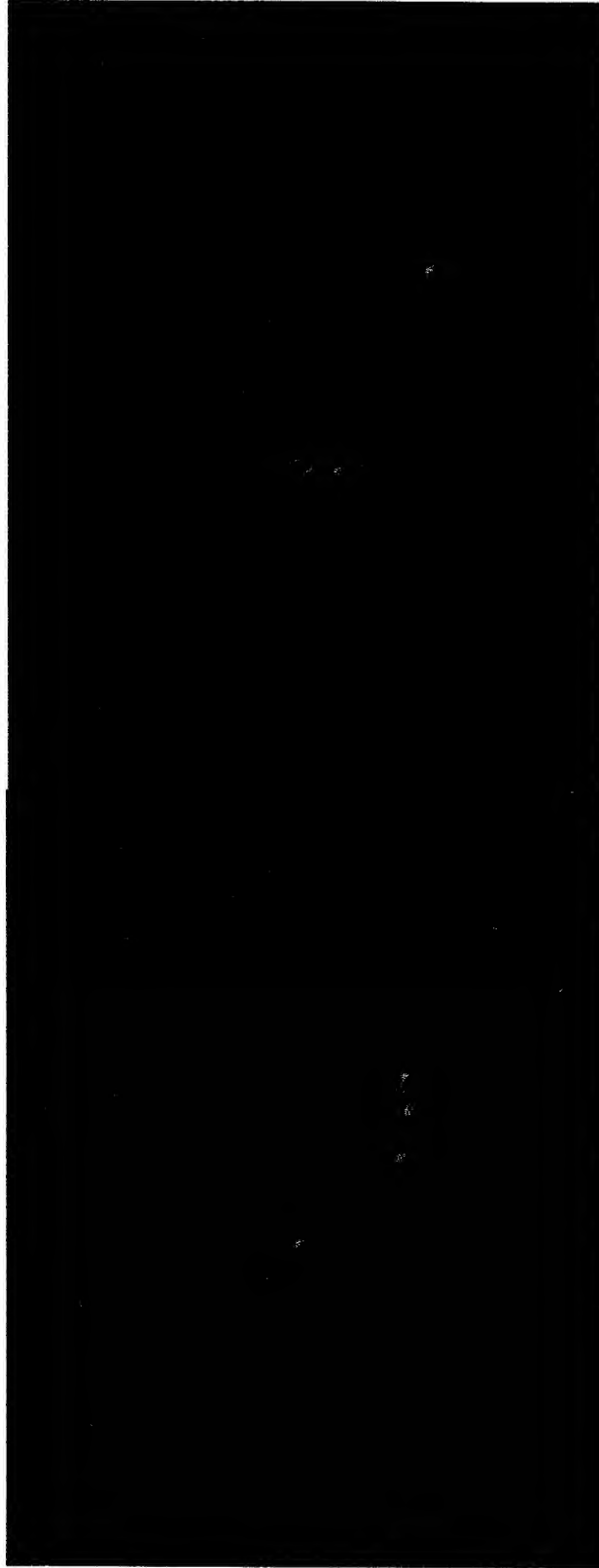**(NOTE: ω_c denotes a characeristic frequency)**



Single Particle (Type 1)

Mixture (Types 1, 2)

Particle Type 1

Particle Type 2

**Particle Collection and Array Assembly**
$\omega < \omega\_c$

**Particle Expulsion**
$\omega\_c < \omega$

**Differential Expulsion**
$\omega\_c(1) < \omega < \omega\_c(2)$

$\omega\_c$ (Type 1) $< \omega\_c$ (Type 2)
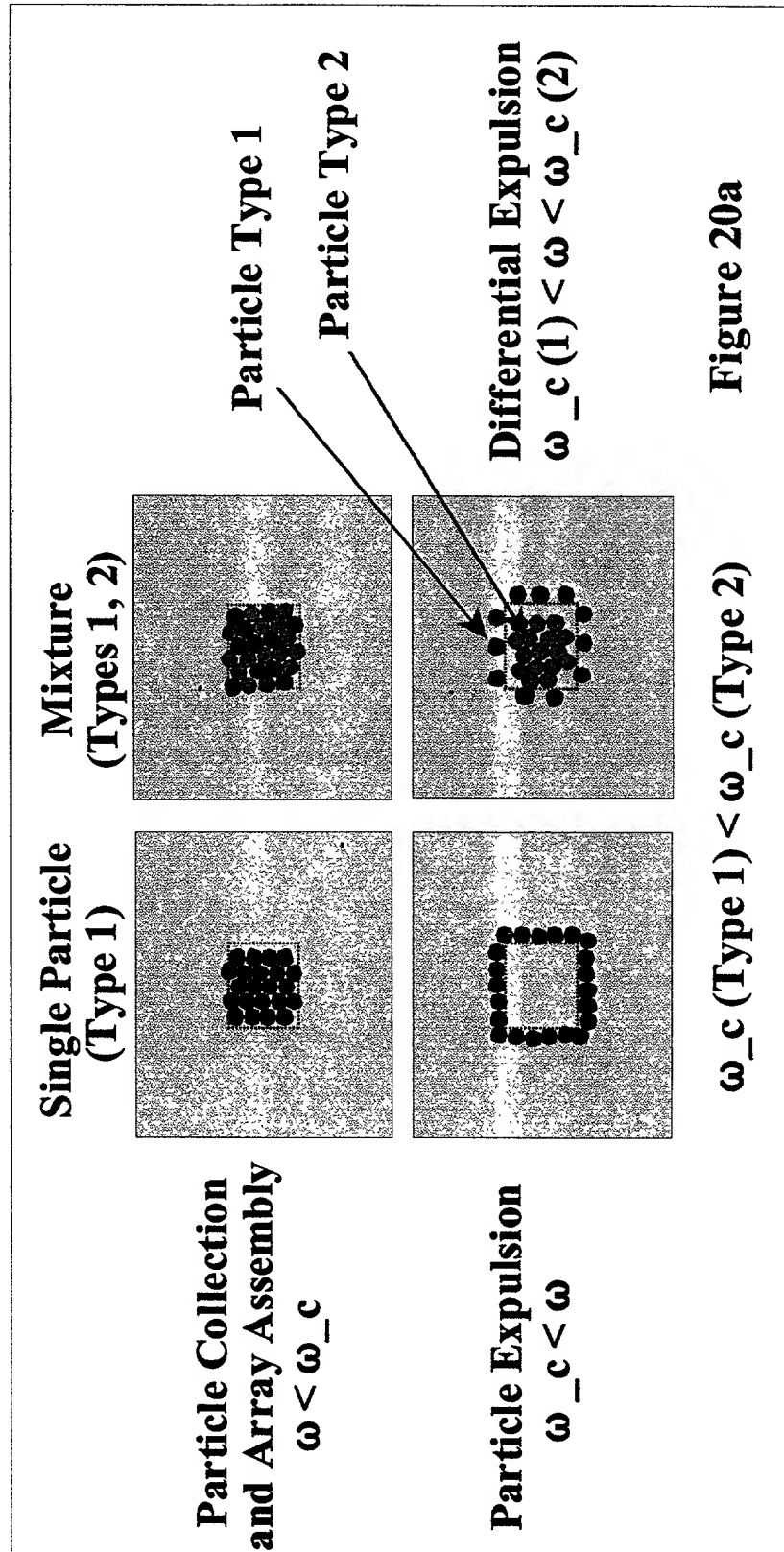
**Figure 20a**

# FRACTIONATION



Illuminated Region

Small particles collected in illuminated rgion

Large particles expelled from illuminated rgion
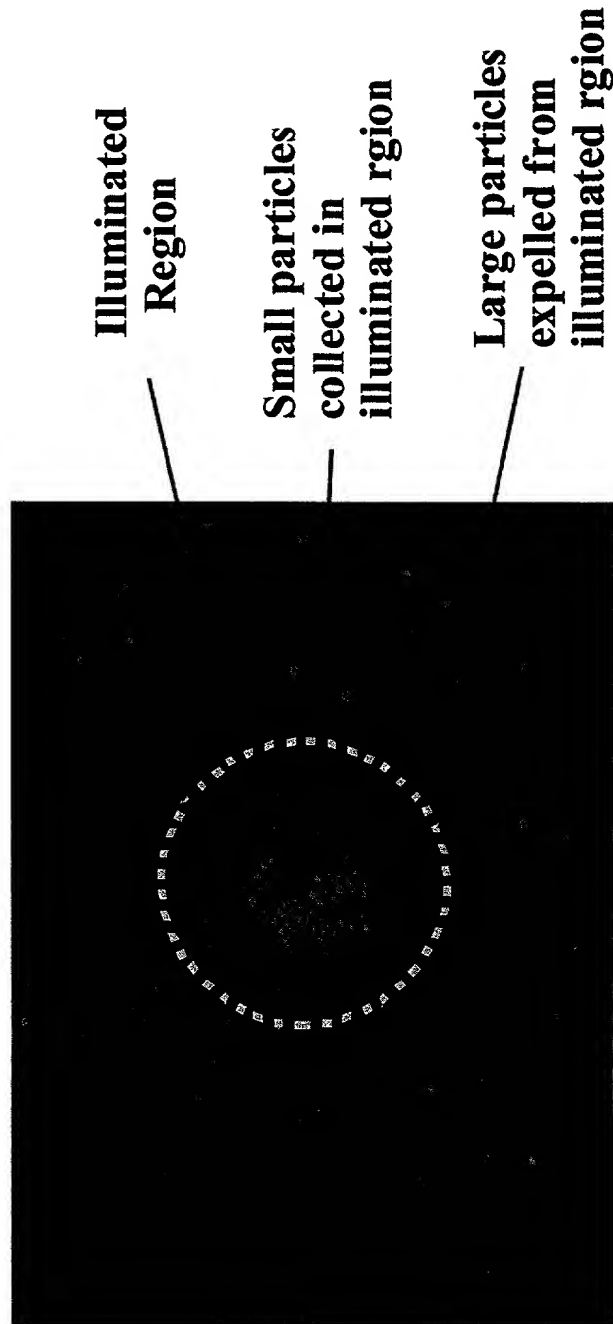
Figure 20b
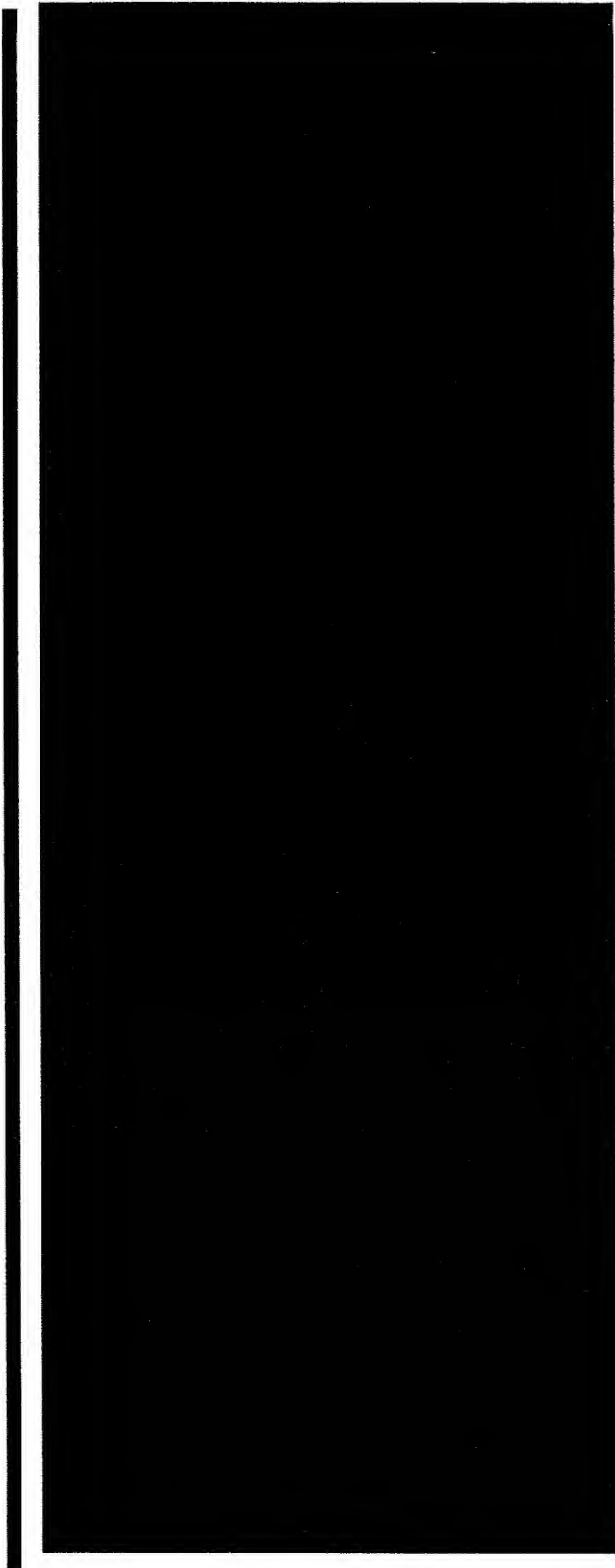
**Figure 21a**
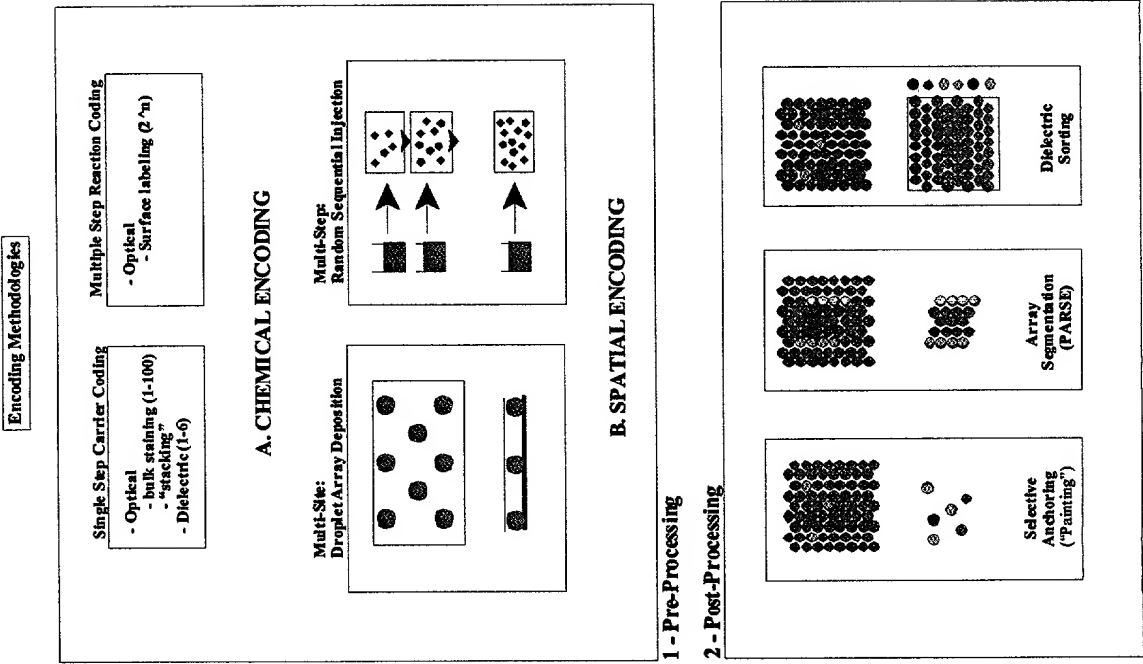
**Figure 21b**

Figure 22a



Figure 22b

# RANDOM SEQUENTIAL INJECTION



Figure 23

# SEQUENTIAL INJECTION &
# LIGHT-CONTROLLED ARRAY PLACEMENT



Figure 24

**MACRO-TO-MICRO TANSITION**

WELLS

CHIP

BEAD
ARRAYS
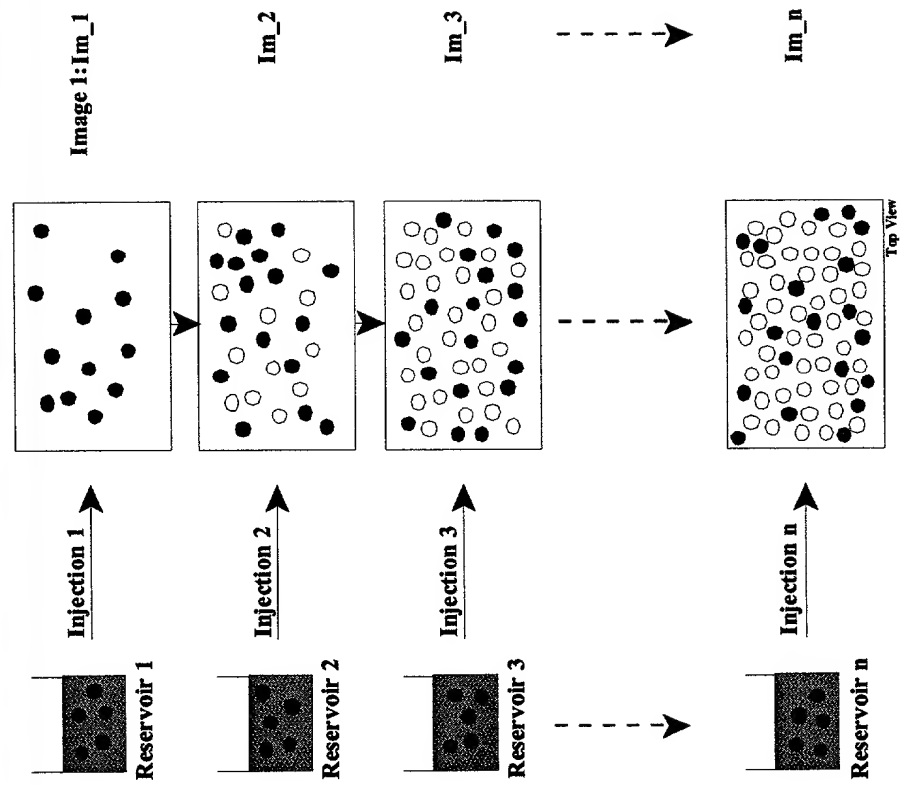
Figure 25a
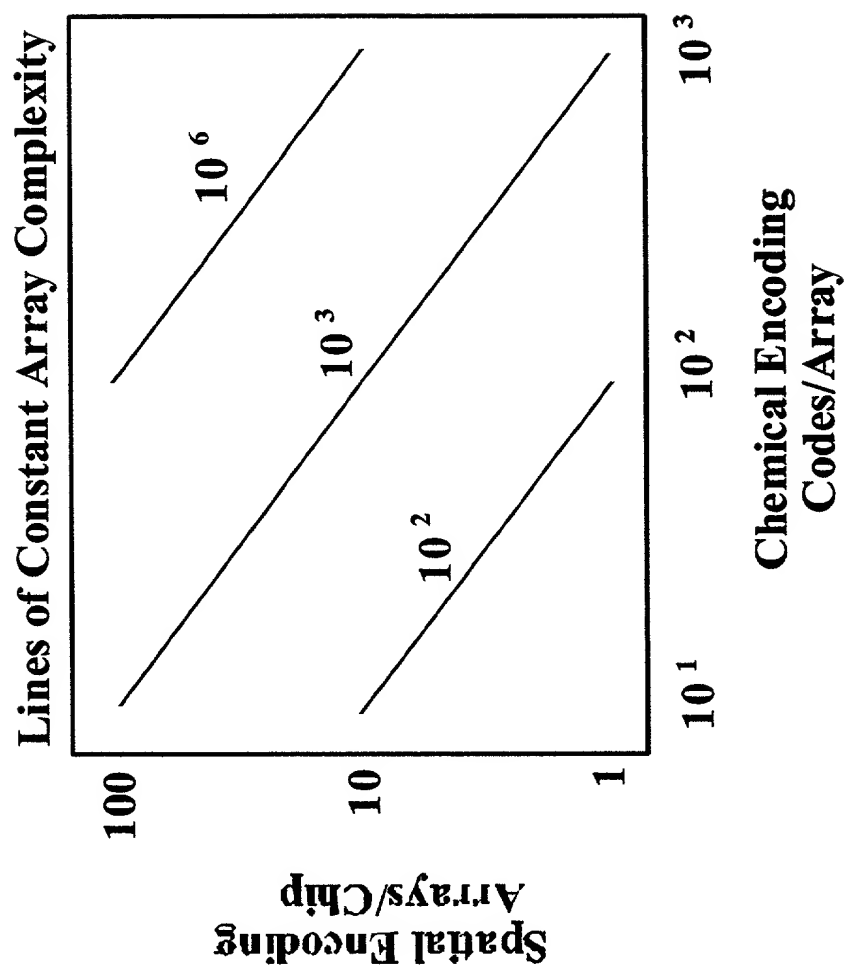
# ARRAY ENCODING



Figure 25b

# ARRAY ENCODING

Reservoirs

r1  r2  r3  r4

Chip With
Multiple
Bead Arrays

r5  r6  r7  r8

Reservoirs
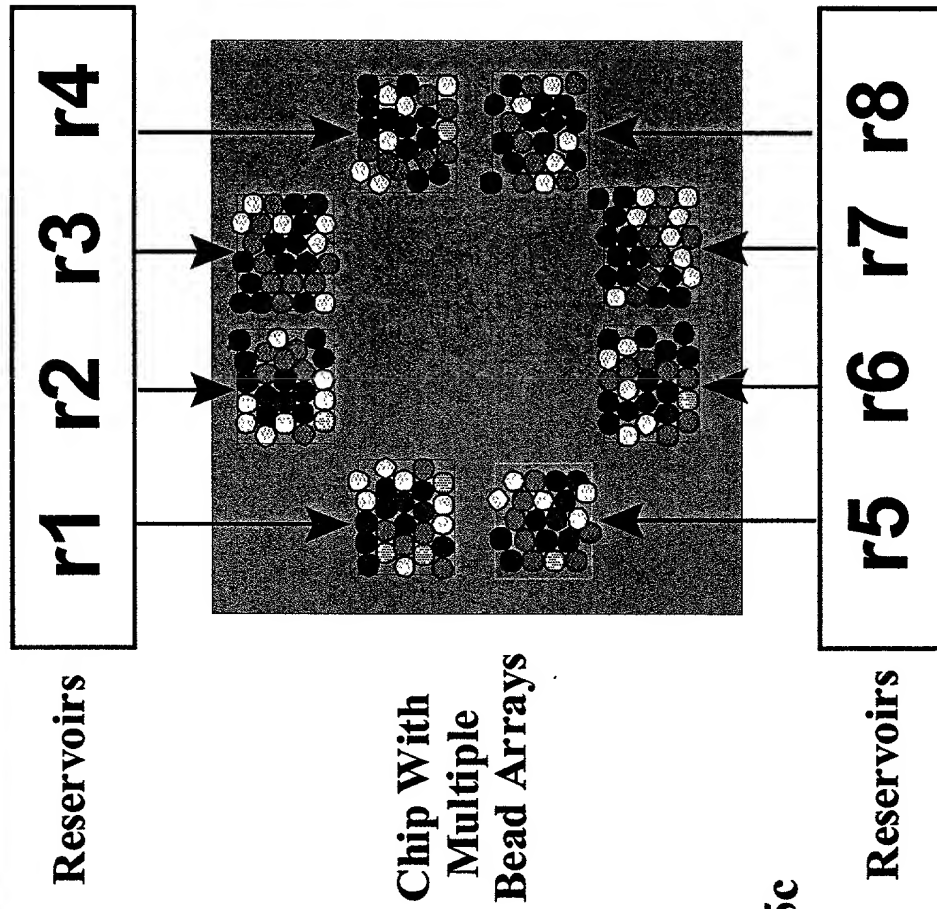
Figure 25c

# SEQUENTIAL ASSEMBLY: "BANDING"
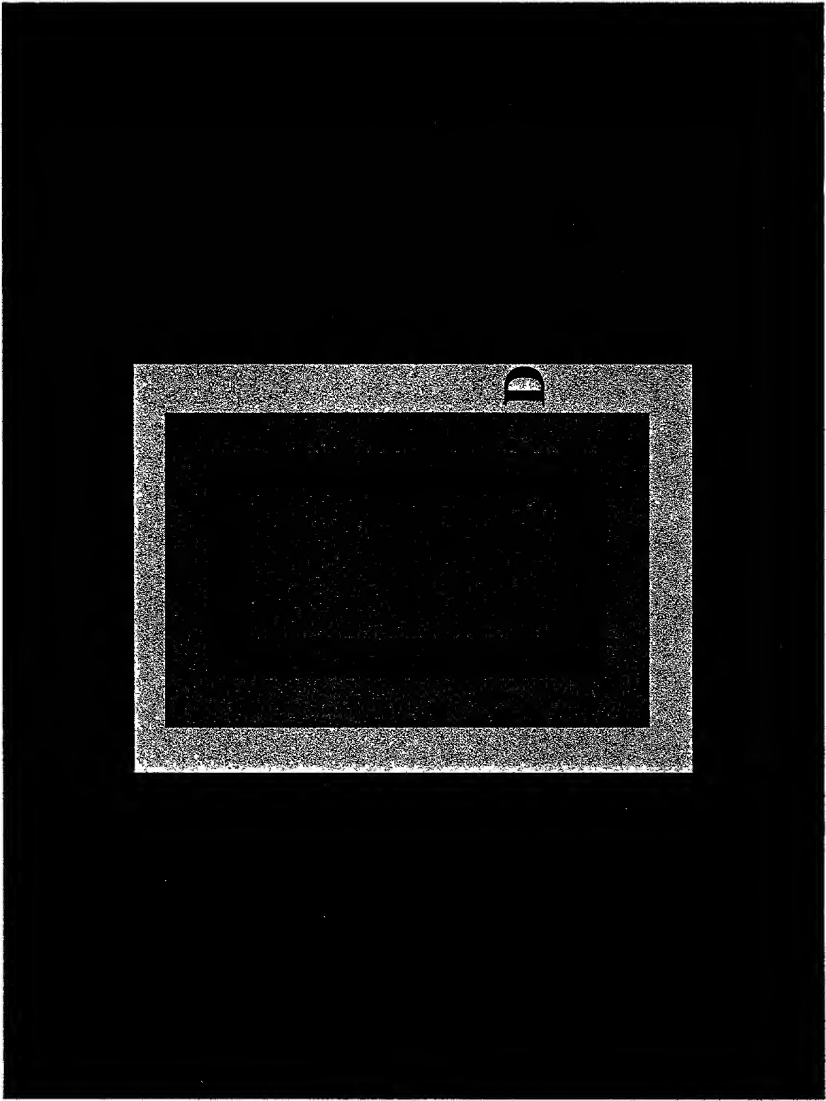


**Figure 26a**

# SEQUENTIAL ASSEMBLY: "BANDING"

## Mixture of Two Particle Types

**Brightfield Image**

**Darkfield Image**

2.8 um   5.5 um
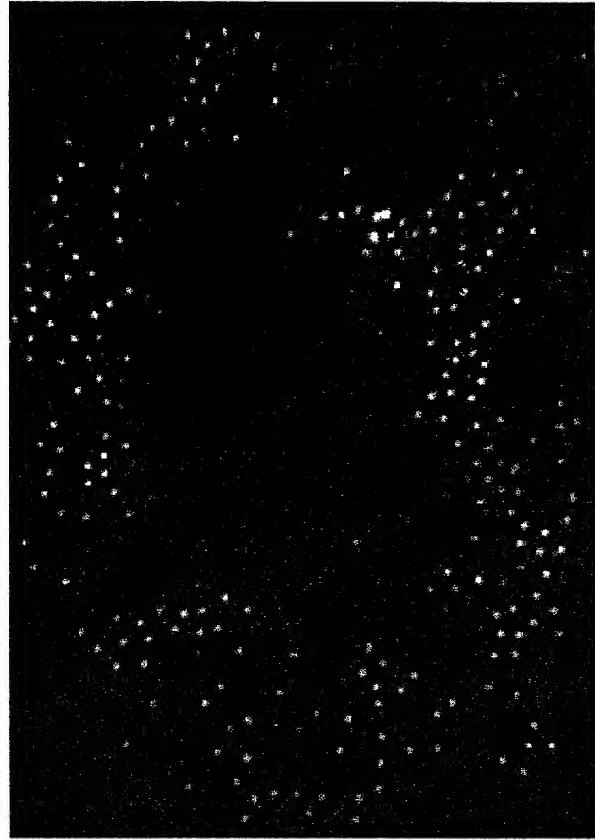
2.8 um   5.5 um
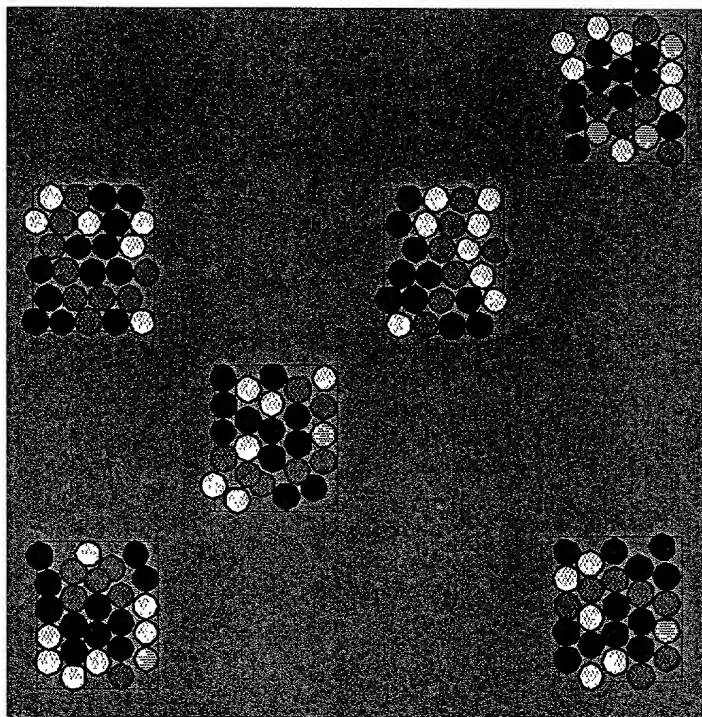
### Figure 26b

LCD PARSE
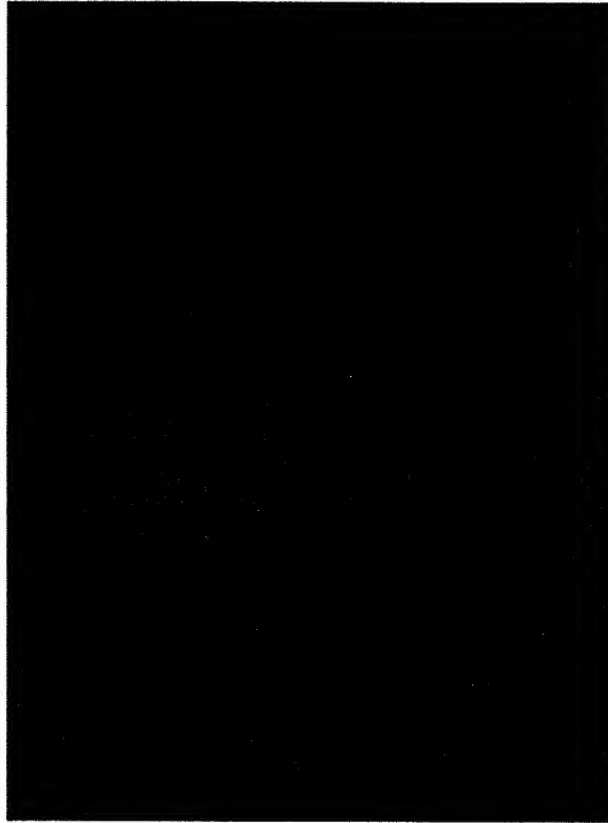


Figure 27

# ARRAY OF RANDOM SUBARRAYS



**Figure 28**

# LIGHT-INDUCED FLUID FLOW



Figure 29